by weight, of sulphite of soda; and 60 parts, by weight, of sodium phosphate are dissolved in 1,000 parts of water. When used the bath must be hot. A cold bath without the addition of potassium cyanide may also be used for gilding, and this consists of 7 parts, by weight, of gold chloride; 30 parts, by weight, of yellow prussiate of potash; 30 parts, by weight, of potash; 30 parts, by weight, of common salt in 1,000 parts of water.

II.—To gild zinc articles, dissolve 20 parts of gold chloride in 20 parts of distilled water, and 80 parts of potassium cyanide in 80 parts of water, mix the solutions, stir a few times, filter, and add tartar, 5 parts, and fine chalk, 100 parts. The resulting paste is applied with a brush. Objects of copper and brass are previously coated with zinc. This is done in the following manner: Heat a concentrated sal ammoniac solution to the boiling point with addition of zinc dust and immerse the thoroughly cleaned objects until a uniform zinc coating has formed. Or boil the articles in a concentrated caustic soda solution with zinc dust.

OXIDIZING PROCESSES:

Aluminum Plating.—I.—To plate iron and other metals with pure aluminum, deoxidize the pieces with a solution of borax and place them in an enameling oven, fitted for receiving metallic vapors. Raise the temperature to 1,832° to 2,732° F. Introduce the aluminum vapors generated by heating a quantity of the metal on the sand bath. When the vapors come in contact with the metallic surfaces, the aluminum is deposited. The vapors that have not been used or are exhausted may be conducted into a vessel of water.

To Copper Aluminum, take

II.—Sulphate of copper.	30	parts
Cream of tartar....	30	parts
Soda.....	25	parts
Water 1,000		parts

The articles to be coppered are merely dipped in this bath, but they must be well cleaned previously.

Antimony Baths.—I.—By dissolving 15 parts, by weight, of tartar emetic and 15 parts of prepared tartar in 500 parts of hot water and adding 45–60 parts of hydrochloric acid and 45–60 parts of powdered antimony, brass becomes coated in the boiling liquid with beautiful antimony colors. In this manner it is possible to impart to brass golden, copper-red, violet, or bluish-gray shades, according to a shorter or longer stay of the objects in the liquid. These antimony colors possess a handsome luster, are permanent, and never change in the air.

II.—Carbonate of soda, 200 parts, by weight; sulphide of antimony, 50 parts; water, 1,000 parts. Heat the whole in a porcelain capsule for 1 hour, keeping constantly in ebullition; next, filter the solution, which, on cooling, leaves a precipitate, which boil again with the liquid for one-half hour, whereupon the bath is ready for use.

To Coat Brass Articles with Antimony Colors.—Dissolve 15 parts, by weight, of tartar emetic and 15 parts, by weight, of powdered tartar in 500 parts, by weight, of hot water and add 50 parts, by weight, of hydrochloric acid, and 50 parts, by weight, of powdered antimony. Into this mixture, heated to a boil, the immersed articles become covered with luster colors, a golden shade appearing at first, which is succeeded by one of copper red. If the objects remain longer in the liquid, the color passes into violet and finally into bluish gray.

Brassing.—I.—To brass small articles of iron or steel drop them into a quart of water and ½ ounce each of sulphate of copper and protochloride of tin. Stir the articles in this solution until desired color is obtained.

II.—Brassing Zinc, Steel, Cast Iron, etc.—Acetate of copper, 100 parts, by weight; cyanide of potassium, 250 parts; bisulphite of soda, 200 parts; liquid ammonia, 100 parts; protochloride of zinc, 80 parts; distilled water, 10,000 parts. Dissolve the cyanide of potassium and the bisulphite of soda. On the other hand, dissolve the ammonia in three-fourths of the water and the protochloride of zinc in the remaining water; next, mix the two solutions. This bath is excellent for brassing zinc and is used cold.

III.—Acetate of copper, 125 parts, by weight; cyanide of potassium, 400 parts; protochloride of zinc, 100 parts; liquid ammonia, 100 parts; distilled water, 8,000 to 10,000 parts. Proceed as above described.

IV.—Acetate of copper, 150 parts, by weight; carbonate of soda, 1,000 parts; bisulcyanide of potassium, 550 parts; bisulphite of soda, 200 parts; protochloride of zinc, 100 parts. Proceed as above. This bath serves for iron, cast iron, and steel, and is used cold.

Colored Rings on Metal.—Dissolve 200 parts, by weight, of caustic potash in 2,000 parts of water and add 50 parts of litharge. Boil this solution for half an hour, taking care that a little of the litharge remains undissolved. When cold, pour off the clear fluid; it is then ready for use. Move the object to and fro in the solution; a yellow-brown color appears, becoming in turn white, yellow, red, and finally a beautiful violet and blue. As soon as the desired color is obtained, remove the article quickly from the solution, rinse in clean water, and dry in sawdust.

Green or Gold Color for Brass.—French articles of brass, both cast and made of sheet brass, mostly exhibit a golden color, which is produced by a copper coating. This color is prepared as follows: Dissolve 50 parts, by weight, of caustic soda and 40 parts of milk sugar in 1,000 parts of water and boil a quarter of an hour. The solution finally acquires a dark-yellow color. Now add to the mixture, which is removed from the fire, 40 parts of concentrated cold blue vitriol solution. A red precipitate is obtained from the vitriol, which falls to the bottom at 167° F. Next a wooden sieve, fitted to the vessel, is put into the liquid with the polished brass articles. Toward the end of the second minute the golden color is usually dark enough. The sieve with the articles is taken out and the latter are washed and dried in sawdust. If they remain in the copper solution they soon assume a green color, which in a short time passes into yellow and bluish green, and finally into the iridescent colors. These shades must be produced slowly at a temperature of 133° to 135° F.

To Give a Green Color to Gold Jewelry.—Take verdigris, 120 parts, by weight; sal ammoniac, 120 parts; nitrate of potassium, 45 parts; sulphate of zinc, 16 parts. Grind the whole and mix with strong vinegar. Place on the fire and boil in it the articles to be colored.

Nickeling by Oxidation.—I.—Nickeling may be performed on all metals cold, by means of nickelene by the Mitressey process, without employing electrical apparatus, and any desired thickness deposited. It is said to be more solid than nickel.

First Bath.—Clean the objects and take 5 parts, by weight, of American potash per 25 parts, by weight, of water. If the pieces are quite rusted, take 2 parts, by weight, of chlorhydric acid per 1 part, by weight, of water. The bath is employed cold.

Second Bath.—Put 250 parts, by weight, of sulphate of copper in 25,000 parts, by weight, of water. After dissolution add a few drops of sulphuric acid, drop by drop, stirring the liquid with a wooden stick until it becomes as clear as spring water.

Take out the pieces thus cleaned and place them in what is called the copper bath, attaching to them leaves of zinc; they will assume a red tint. Then pass them into the nickeling bath, which is thus composed:

	By weight
Cream of tartar	20 parts
Sal ammoniac, in powder	10 parts
Kitchen salt	5 parts
Stannous chloride	20 parts
Sulphate of nickel, single	30 parts
Sulphate of nickel, double	50 parts

Remove the pieces from the bath in a few minutes and rub them with fine sand on a moist rag. Brilliancy will thus be obtained. To improve the appearance, apply a brass wire brush. The nickeling is said to be more solid and beautiful than that obtained by the electrical method.

Brilliancy may be also imparted by means of a piece of buff glued on a wooden wheel and smeared with English red stuff. This will give a glazed appearance.

II.—Prepare a bath of neutral zinc chloride and a neutral solution of a nickel salt. The objects are immersed in the bath with small pieces of zinc and kept boiling for some time. This process has given satisfactory results. It is easy to prepare the zinc chloride by dissolving it in hydrochloric acid, as well as a saturated solution of ammoniacal nickel sulphate in the proportion of two volumes of the latter to one of the zinc chloride. The objects should be boiled for 15 minutes in the bath. Nickel salt may also be employed, preferably in the state of chloride.

Pickling Solutions.—Oxidized copper, brass, and German silver articles must be cleansed by acid solutions. In the case of brass alloys, this process, through which the object acquires a dull yellow surface, is known as dipping or yellowing. The treatment consists of

several successive operations. The article is first boiled in a lye composed of 1 part caustic soda and 10 parts water, or in a solution of potash or soda or in limewater; small objects may be placed in alcohol or benzine. When all the grease has been removed, the article is well rinsed with water, and is then ready for the next pickling. It is first plunged into a mixture of 1 part sulphuric acid and 10 parts water, and allowed to remain in it till it acquires a reddish tinge. It is then immersed in 40° Bé. nitric acid, for the purpose of removing the red tinge, and then for a few seconds into a bath of 1 part nitric acid, 1.25 parts sulphuric acid of 66° Bé., 0.01 part common salt, and 0.02 parts lampblack. The article must then be immediately and carefully washed with water till no trace of acid remains. It is then ready for galvanizing or drying in bran or beech sawdust. When articles united with soft solder are pickled in nitric acid, the solder receives a gray-black color.

Palladiumizing Watch Movements.—Palladium is successfully employed for coating parts of timepieces and other pieces of metals to preserve them against oxidation. To prepare a palladium bath use the following ingredients: Chloride of palladium, 10 parts, by weight; phosphate of ammonia, 100 parts; phosphate of soda, 300 parts; benzoic acid, 8 parts; water, 2,000 parts.

Metal Browning by Oxidation.—The article ought first to be cleaned with either nitric acid or muriatic acid, then immersed in an acid affecting the metal and dried in a warm place. A light coating is thus formed. For a second coating acetic or formic acid is used preferably for aluminum, nickel, and copper; but for iron and steel, muriatic or nitric acid. After cleaning, the article is placed in a solution of tannin or gallic acid, and is then dried in a warm place as before. The second coating is of a yellowish-brown color. On placing it near the fire, the color can be deepened until it becomes completely black; care must be taken to withdraw it when the desired shade is produced. Instead of the acids employed for the first coating, ammonia may be used.

Silvering by Oxidation.—The oxidizing of silver darkens it, and gives an antique appearance that is highly prized.

I.—The salts of silver are colorless when the acids, the elements of which enter into their composition, are not colored, but they generally blacken on exposure to light. It is easy, therefore, to blacken silver and obtain its oxide; it is sufficient to place it in contact with a sulphide, vapor of sulphur, sulphohydric acids, such as the sulphides or polysulphides of potash, soda, dissolved in water and called *eau de barège*. The chlorides play the same part, and the chloride of lime in solution or simply Javelle water may be used. It is used hot in order to accelerate its action. The bath must be prepared new for each operation for two reasons: (1) It is of little value; (2) the sulphides precipitate rapidly and give best effects only at the time of their direct precipitations. The quantity of the reagent in solution, forming the bath, depends upon the thickness of the deposit of silver. When this is trifling, the oxidation penetrates the entire deposit and the silver exfoliates in smaller scales, leaving the copper bare. It is necessary, therefore, in this case to operate with dilute baths inclosing only about 45 grains of oxidizant at most per quart. The operation is simple: Heat the necessary quantity of water, add the sulphide or chloride and agitate to effect the solution of the mixture, and then at once plunge in the silver-plated articles, leaving them immersed only for a few seconds, which exposure is sufficient to cover it with a pellicle of deep black-blue silver. After withdrawing they are plunged in clean cold water, rinsed and dried, and either left mat or else polished, according to the nature of the articles.

Should the result not be satisfactory, the articles are brightened by immersing them in a lukewarm solution of cyanide of potassium. The oxide, the true name of which would be the sulphuret or chloruret, can be raised only on an object either entirely of silver or silver plated.

II.—Rub the article with a mixture of graphite, 6 parts, and powdered bloodstone, 1 part, moistened with oil of turpentine. Allow to dry and brush with soft brushes passed over wax. Or else, brush with a soft brush wet with alcoholic or aqueous platinic chloride solution of 1 in 20.

III.—Sulphurizing is effected with the following methods: Dip in a solution heated to about 175° F., of potassium sulphide, 5 parts, by weight; ammonium carbonate, 10 parts; water, 1,000 parts; or, calcium sulphide, 1 to 2 parts; sal ammoniac, 4 parts; water, 1,000 parts.

IV.—In the following solution articles of silver obtain a warm brown tone: Copper sulphate, 20 parts, by weight; potassium nitrate, 10 parts; ammonium chloride, 20 parts. By means of bromine, silver and silver alloys receive a black coloring. On engraved surfaces a niello-like effect may be produced thereby.

Oxidized Steel.—I.—Mix together bismuth chloride, 1 part; mercury bichloride, 2 parts; copper chloride, 1 part; hydrochloric acid, 6 parts; alcohol, 5 parts; and water, 5 parts. To use this mixture successfully the articles to be oxidized must be cleaned perfectly and freed from all grease, which is best accomplished by boiling them in a soda solution or by washing in spirit of wine. Care should be taken not to touch the article with the fingers again after this cleaning. However clean the hand may be, it always has grease on it and leaves spots after touching, especially on steel. Next the object is dipped into the liquid, or if this is not possible the solution is applied thin but evenly with a brush, pencil, or rabbit's foot. When the liquid has dried, the article is placed for a half hour in simple boiling water. If a very dark shade is desired the process is repeated until the required color is attained.

II.—Apply, by means of a sponge, a solution of crystallized iron chloride, 2 parts; solid butter of antimony, 2 parts; and gallic acid, 1 part in 5 parts of water. Dry the article in the air and repeat the treatment until the desired shade is reached. Finally rinse with water, dry, and rub with linseed-oil varnish.

Tinning by Oxidation.—A dipping bath for tinning iron is prepared by dissolving 300 parts, by weight, ammonia alum (sulphate of alumina and sulphate of ammonia) and 10 parts of melted stannous chloride (tin salt) in 20,000 parts of warm water. As soon as the solution boils, the iron articles, previously pickled and rinsed in fresh water, are plunged into the fluid; they are immediately covered with a layer of tin of a beautiful dull-white color, which can be made bright by treatment in a tub or sack. Small quantities of tin salt are added from time to time as may be required to replace the tin deposited on the iron. This bath is also well adapted for tinning zinc, but here also, as with iron, the deposit is not sufficient to prevent oxidation of the metal below. Larger articles tinned in this way are polished by scratch brushing. In tinning zinc by this process, the ammonia alum may be replaced by any other kind of alum, or aluminum sulphate may be used alone; experience has shown, however, that this cannot be done with iron, cast iron, or steel. If it is desired to tin other metals besides iron and zinc in the solution which we have described, the battery must be resorted to; if the latter is used, the above solution should be applied in preference to any other.

PATINA OXIDIZING PROCESSES:

Patina of Art Bronzes. — For all patinas, whether the ordinary brown of commerce, the green of the Barye bronzes, or the dark-orange tint of the Florentine bronzes, a brush is used with pigments varying according to the shade desired and applied to the metal after it is warmed. Recipes are to be met with on every hand that have not been patented. But the details of the operation are the important thing, and often the effect is produced by a handicraft which it is difficult to penetrate.

I.—A dark tint may be obtained by cleaning the object and applying a coat of hydrosulphate of ammonia; then, after drying it, by rubbing with a brush smeared with red chalk and plumbago. The copper may also be moistened with a dilute solution of chloride of platina and warmed slightly, or still by plunging it in a warm solution of the hydrochlorate of antimony. For the verde antique a solution is recommended composed of 200 grams of acetic acid of 8° strength, the same quantity of common vinegar, 30 parts, by weight, of carbonate of ammonia; 10 parts, by weight, of sea salt; with the same quantities of cream of tartar and acetate of copper and a little water. To obtain the bronze of medals several processes afford a selection: For example, the piece may be dipped in a bath consisting of equal parts of the perchloride and the sesquiazotate of iron, warming to the evaporation of the liquid, and rubbing with a waxed brush.

II.—Dissolve copper nitrate, 10 parts, by weight, and kitchen salt, 2 parts, in 500 parts of water and add a solution of ammonium acetate obtained by neutralization of 10 parts of officinal spirit of sal ammoniac with acetic acid to a faintly acid reaction, and filling up with water to 500 parts. Immerse the bronze, allow to dry, brush off superficially and repeat this until the desired shade of color has been obtained.

A Permanent Patina for Copper.—

Green.—

I.—Sodium chloride. 37 parts
Ammonia water.. 75 parts
Ammonium chloride..... 37 parts
Strong wine vinegar..... 5,000 parts

Mix and dissolve. Apply to object to be treated, with a camel's-hair pencil. Repeat the operation until the desired shade of green is reached.

Yellow Green.—

II.—Oxalic acid..... 5 parts
Ammonium chloride..... 10 parts
Acetic acid, 30 per cent dilution.... 500 parts

Mix and dissolve. Use as above indicated. The following will produce the same result:

III.—Potassium oxalate, acid..... 4 parts
Ammonium chloride.....16–17 parts
Vinegar containing 6 per cent of acetic acid..... 1,000 parts

IV.—Bluish Green.—After using the first formula (for green) pencil over with the following solution:

Ammonium chloride..... 40 parts
Ammonium carbonate..... 120 parts
Water..... 1,000 parts

Mix and dissolve.

Greenish Brown.—

V.—Potassium sulphuret..... 5 parts
Water..... 1,000 parts

Mix and dissolve. With this, pencil over object to be treated, let dry, then pencil over with 10 parts a mixture of a saturated solution of ammonia water and acetic acid and 5 parts of ammonium chloride thinned with 1,000 parts of water. Let dry again, then brush off well. Repeat, if necessary, until the desired hue is attained.

Another Blue Green.—

VI.—Corrosive sublimate. 25 parts
Potassium nitrate.. 86 parts
Borax..... 56 parts
Zinc oxide..... 113 parts
Copper acetate...220–225 parts

Mix and heat together on the surface of the object under treatment.

VII.—Brown.—The following is a Parisian method of producing a beautiful deep brown:

Potassium oxalate, acid..... 3 parts
Ammonium chloride..... 15 parts
Water, distilled.... 280 parts

Mix and dissolve. The object is penciled over with this several times, each time allowing the solution to dry before putting on any more. The process is slow, but makes an elegant finish.

Green Patina Upon Copper.—To produce a green patina upon copper take tartaric acid, dilute it half and half with boiling water; coat the copper with this; allow to dry for one day and rub the applied layer off again the next day with oakum. The coating must be done in dry weather, else no success will be obtained. Take hydrochloric acid and dilute it half and half with boiling water, but the hydrochloric acid should be poured in the water, not vice-versa, which is dangerous. In this hydrochloric acid water dissolve as much zinc as it can solve and allow to settle. The clear liquid is again diluted half with boiling water and the copper is coated with this a few times.

Black Patina.—Black patina is obtained by coating with tallow the pieces to be oxidized and lighting with a rosin torch. Finally, wipe the reliefs and let dry.

Blue-Black Patina.—Use a dilute solution of chloride of antimony in water and add a little free hydrochloric acid. Apply with a soft brush, allow the article to dry and rub with a flannel. If expense is no object, employ a solution of chloride of palladium, which gives a magnificent blue black. It is necessary, however, to previously clean the articles thoroughly in a hot solution of carbonate of soda, in order to remove the dirt and greasy matter, which would prevent the patina from becoming fixed.

Red Patina.—The following is a new method of making a red patina, the so-called blood bronze, on copper and copper alloys. The metallic object is first made red hot, whereby it becomes covered with a coating consisting of cupric oxide on the surface and cuprous oxide beneath. After cooling, it is worked upon with a polishing plate until the black cupric oxide coating is removed and the cuprous oxide appears. The metal now shows an intense red color,

with a considerable degree of luster, both of which are so permanent that it can be treated with chemicals, such as blue vitriol, for instance, without being in the least affected.

If it is desired to produce a marbled surface, instead of an even red color, borax or some chemical having a similar action is sprinkled upon the metal during the process of heating. On the places covered by the borax, oxidation is prevented, and after polishing, spots of the original metallic color will appear in the red surface. These can be colored by well-known processes, so as to give the desired marbled appearance.

PLATINIZING:

Platinizing Aluminum. — Aluminum vessels coated with a layer of platinum are recommended in place of platinum vessels, when not exposed to very high temperatures. The process of platinizing is simple, consisting in rubbing the aluminum surface, previously polished, with platinic chloride, rendered slightly alkaline. The layer of platinum is made thicker by repeated application. Potash lye is carefully added to a solution of 5 to 10 per cent of platinic chloride in water till a slightly alkaline reaction is produced on filtering paper or a porcelain plate by means of phenolphthalein. This solution must always be freshly prepared, and is the best for the purpose. Neither galvanizing nor amalgamating will produce the desired result. Special care must be taken that the aluminum is free from iron, otherwise black patches will arise which cannot be removed. Vessels platinized in this way must not be cleaned with substances such as sea-sand, but with a 5 to 10 per cent solution of oxalic acid in water, followed by thorough rinsing in water. These vessles are said to be specially suitable for evaporating purposes.

Platinizing Copper and Brass.—I.—The articles are coated with a thin layer of platinum in a boiling solution of platinum sal ammoniac, 1 part; sal ammoniac, 8 parts; and water, 40 parts, and next polished with chalk. A mixture of equal parts of platinum sal ammoniac and tartar may also be rubbed on the objects. Steel and iron articles can be platinized with an ethereal solution of platinic chloride. For small jewelry the boiling solution of platinic chloride, 10 parts; cooking salt, 200 parts; and water, 1,000 parts, is employed, which is rendered alkaline with soda lye. In this, one may also work with zinc contact.

II.—Heat 800 parts of sal ammoniac and 10 parts of platinum sal ammoniac to the boiling point with 400 parts of water, in a porcelain dish, and place the articles to be platinized into this, whereby they soon become covered with a coating of platinum. They are then removed from the liquid, dried and polished with whiting.

Platinizing on Glass or Porcelain.—First dissolve the platinum at a moderate temperature in aqua regia, and next evaporate the solution to dryness, observing the following rules: When the solution commences to turn thick it is necessary to diminish the fire, while carrying the evaporation so far that the salt becomes dry, but the solution should not be allowed to acquire a brown color, which occurs if the heat is too strong. The result of this first operation is chloride of platina. When the latter has cooled off it should be dissolved in alcohol (95 per cent). The dissolution accomplished, which takes place at the end of 1 or 2 hours, throw the solution gradually into four times its weight of essence of lavender, then put into a well-closed flask.

For use, dip a brush into the solution and apply it upon the objects to be platinized, let dry and place in the muffle, leaving them in the oven for about one-half hour. In this operation one should be guided as regards the duration of the baking by the hardness or fusibility of the objects treated. The platinization accomplished, take a cotton cloth, dipped into whiting in the state of pulp, and rub the platinated articles with this, rinsing with water afterwards.

Platinizing Metals.—Following are several processes of platinizing on metals:

It is understood that the metals to be covered with platinum must be copper or coppered. All these baths require strong batteries.

I.—Take borate of potash, 300 parts, by weight; chloride of platina, 12 parts; distilled water, 1,000 parts.

II.—Carbonate of soda, 250 parts, by weight; chloride of platina, 10 parts; distilled water, 1,000 parts.

III.—Sulphocyanide of potash, 12 parts, by weight; chloride of platina, 12 parts; carbonate of soda, 12 parts; distilled water, 1,000 parts.

IV.—Borate of soda, 500 parts, by weight; chloride of platina, 12 parts; distilled water, 1,000 parts.

SILVERING, SILVER-PLATING, AND DESILVERING:

See also Silvering by Oxidation, under Oxidation Processes, under Plating.

Antique Silver—There are various processes for producing antique silver, either fat or oxidized:

To a little copal varnish add some finely powdered ivory black or graphite. Thin with spirits of turpentine and rub with a brush dipped into this varnish the objects to be treated. Allow to dry for an hour and wipe off the top of the articles with some rag, so that the black remains only in the hollows. If a softer tint is desired, apply again with a dry brush and wipe as the first time. The coating of black will be weaker and the shade handsomer.

Britannia Silver-Plating.—I.—The article should first be cleaned and then rubbed by means of a wet cloth with a pinch of powder obtained by mixing together: Nitrate of silver, 1 part; cyanide of potassium, 2 parts; chalk, 5 parts. Then wipe with a dry cloth, and polish well with rouge to give brilliancy.

II.—By the electric method the metal is simply plunged into a hot saturated solution of crude potassium carbonate, and the plating is then done directly, using a strong electrical current. The potassium carbonate solution dissolves the surface of the britannia metal and thus enables the silver to take a strong hold on the article.

To Silver Brass, Bronze, Copper, etc.—I.—In order to silver copper, brass, bronze, or coppered metallic articles, dissolve 10 parts of lunar caustic in 500 parts of distilled water, and 35 parts of potassium cyanide (98 per cent) in 500 parts of distilled water; mix both solutions with stirring, heat to 176° to 194° F. in an enameled vessel, and enter the articles, well cleansed of fat and impurities, until a uniform coating has formed.

II.—Zinc, brass, and copper are silvered by applying a paste of the following composition: Ten parts of silver nitrate dissolved in 50 parts of distilled water, and 25 parts of potassium cyanide dissolved in distilled water; mix, stir, and filter. Moisten 100 parts of whiting and 400 parts of powdered tartar with enough of the above solution to make a paste-like mass, which is applied by means of a brush on the well-cleaned objects. After the drying of this coating, rinse off, and dry in sawdust.

III.—To silver brass and copper by friction, rub on the articles, previously cleaned of grease, a paste of silver chloride, 10 parts; cooking salt, 20 parts; powdered tartar, 20 parts; and the necessary water, using a rag.

Desilvering.—I.—It often happens in plating that, notwithstanding all precautions, some pieces have failed and it is necessary to commence the work again. For removing the silver that has been applied, a rapid method is to take sulphuric acid, 100 parts, and nitrate of potash, 10 parts. Put the sulphuric acid and the nitrate of potash (saltpeter) in a vessel of stoneware or porcelain, heated on the water bath. When the silver has been removed from the copper, rinse the object several times and recommence the silvering. This bath may be used repeatedly, taking care each time to put it in a stoppered bottle. When it has been saturated with silver and has no more strength, decant the deposit, boil the liquor to dryness, add the residue to the deposit, and melt in a crucible to regenerate the metal.

II.—To dissolve the silver covering of a metallic object, a bath is made use of, composed of 66 per cent sulphuric acid, 3 parts, and 40 per cent nitric acid, 1 part. This mixture is heated to about 176° F., and the objects to be desilvered are suspended in it by means of a copper wire. The operation is accomplished in a few seconds. The objects are washed and then dried in sawdust.

To Silver Glass Balls and Plate Glass.—The following is a method for silvering the glass balls which are used as ornaments in gardens, glass panes, and concave mirrors: Dissolve 300 parts of nitrate of silver and 200 parts of ammonia in 1,300 parts of distilled water. Add 35 parts of tartaric acid dissolved in 4 times its weight of water. Dilute the whole with 15,000 to 17,000 parts of distilled water. Prepare a second solution containing twice the amount of tartaric acid as the preceding one. Apply each of these solutions successively for 15 to 20 minutes on the glass to be silvered, which must previously have been cleaned and dried. When the silvering is sufficient, wash the object with hot water, let dry, and cover with a brown varnish.

Iron Silver-Plating.—I.—Iron articles are plated with quicksilver in a solution of nitrate of mercury before being silvered. The quicksilver is then removed by heating to 572° F. The articles may also be first tinned to economize the silver. Steel is dipped in a mixture of

nitrate of silver and mercury, each dissolved separately in the proportion of 5 parts, by weight, to 300 parts, by weight, of water, then wiped to remove the black film of carbon, and silvered till a sample dipped in a solution of blue vitriol ceases to turn red. According to H. Krupp, articles made of an alloy of nickel, copper, and zinc, such as knives, forks, spoons, etc., should be coated electrically with nickel, put into a solution of copper like that used for galvanic coppering, and then electroplated.

II.—A brilliant silver color may be imparted to iron (from which all grease has been previously removed) by treating it with the following solution: Forty parts, by weight, chloride of antimony; 10 parts, by weight, powdered arsenious acid; and 80 parts levigated hematite are mixed with 1,000 parts of 90 per cent alcohol and gently heated for half an hour on a water bath. A partial solution takes place, and a small cotton pad is then dipped in the liquid and applied with a gentle pressure to the iron. A thin film consisting of arsenic and antimony is precipitated, as described by Dr. Langbein, in his "Handbuch der galv. Metallniederschläge." The brilliancy of the effect depends upon the care with which the iron has previously been polished.

To Silver-Plate Metals.—I.—Nitrate of silver, 30 parts, by weight; caustic potash, 30 parts; distilled water, 100 parts. Put the nitrate of silver into the water; one-quarter hour afterwards add the potash, and, when the solution is done, filter. It is sufficient to dip the objects to be silvered into this bath, moving them about in it for 1 or 2 minutes at most; then rinsing and drying in sawdust. It is necessary to pickle the pieces before using the bath. To make the nitrate of silver one's self, take 30 parts of pure silver and 60 parts of nitric acid, and when the metal is dissolved add the caustic potash and the water.

II.—Kayser's silvering liquid, which is excellent for all kinds of metals, is prepared from lunar caustic, 11 parts; sodium hyposulphite, 20 parts; sal ammoniac, 12 parts; whiting, 20 parts; and distilled water, 200 parts. The articles must be cleaned well.

Mosaic Silver.—This compound consists of tin, 3 parts, by weight; bismuth, 3 parts; and mercury, 1½ parts. The alloy of these metals is powdered finely, thus forming a silvery mass used for imitation silvering of metals, paper, wood, etc. In order to impart to metals, especially articles of copper and brass, an appearance similar to silver, they are made perfectly bright. The powder of the mosaic silver is mixed with six times the volume of bone ashes, adding enough water to cause a paste and rubbing this on the metallic surface by means of a cork of suitable shape. In order to silver paper by means of this preparation it is ground with white of egg, diluted mucilage, or varnish, and treated like a paint.

Pastes for Silvering.—I.—Carbonate of lime, 65 parts; sea salt, 60 parts; cream of tartar, 35 parts; nitrate of silver, 20 parts. Bray all in a mortar, not adding the carbonate of lime until the other substances are reduced to a fine powder. Next, add a little water to form a homogeneous paste, which is preserved in blue bottles away from the light. For use, put a little of this paste on a small pad and rub the article with it.

II.—Articles of zinc, brass, or copper may also be silver-plated by applying to them a pasty mass of the following composition: First dissolve 10 parts, by weight, of nitrate of silver in 50 parts, by weight, of distilled water; also 25 parts, by weight, of potassium cyanide in sufficient distilled water to dissolve it. Pour the two together, stir well, and filter. Now 100 parts, by weight, of whiting or levigated chalk and 400 parts, by weight, of potassium bitartrate, finely powdered, are moistened with the above solution sufficiently to form a soft paste, which may be applied to the objects, previously well cleansed, with a brush. After this coating has dried well, rinse it off, and dry the object in clean sawdust.

Resilvering.—I.—Take 100 parts, by weight, of distilled water and divide it into two equal portions. In the one dissolve 10 parts of silver nitrate and in the other 25 parts of potassium cyanide. The two solutions are reunited in a single vessel as soon as completed. Next prepare a mixture of 100 parts of Spanish white, passed through a fine sieve, 10 parts of cream of tartar, pulverized, and 1 part of mercury. This powder is stirred in a portion of the above liquid so as to form a rather thick paste. The composition is applied by means of the finger, covered with a rag, on the object to be silvered. The application must be as even as possible. Let the object dry and wash in pure water. The excess of powder is removed with a brush.

II.—The following is a process used when the jeweler has to repair certain pieces from which silvering has come off

in places, and which he would like to repair without having recourse to the battery, and specially without having to take out the stones or pearls: Take nitrate of silver, 25 parts, by weight; cyanide of potassium, 50 parts; cream of tartar, 20 parts; Paris white, 200 parts; distilled water, 200 parts; mercury, 2 parts. Dissolve the nitrate of silver in half of the distilled water and the cyanide in the other half; mix the two liquids; next bray well in a mortar the mercury, Paris white, and cream of tartar. Preserve the products of these two operations separately, and when you wish to use them make a rather soft paste of the two, which apply with a little cotton or a brush on the portion to be silvered. Let dry and subsequently rub with a soft brush.

Tin Silver-Plating.—Prepare a solution of 3 parts, by weight, of bismuth subnitrate in 10 parts of nitric acid of 1.4 specific gravity, to which add a solution of 10 parts of tartar and 40 parts of hydrochloric acid in 1,000 parts of water. In the mixture of these solutions immerse the tin articles freed from grease and oxide. The pulverous bismuth precipitated on the surface is rubbed off, whereupon the objects appear dark steel gray. For silvering prepare a mixture of 10 parts of silver chloride; 30 parts of cooking salt; 20 parts of tartar, and 100 parts of powdered chalk, which is rubbed in a slightly moist state on the bismuth surface of the tin articles, using a flannel rag. The silver separates only in a very thin layer, and must be protected against power and light before tarnishing by a coating of preservative or celluloid varnish.

Zinc Contact Silver-Plating.—According to Buchner, 10 parts, by weight, of silver nitrate is dissolved in water and precipitated by the addition of hydrochloric acid in the form of silver chloride, which is washed several times in clean water; now dissolve 70 parts, by weight, of spirit of sal ammoniac in water, and add to it 40 parts, by weight, of soda crystals, 40 parts, by weight, of pure potassium cyanide, and 15 parts, by weight, of common salt. Now thin down the compound with sufficient distilled water to make a total of 1,000 parts.

Tin Plating of Lead.—Lead plates are best tinned by plating. For this purpose a table with a perfectly even iron surface and provided with vertical raised edges to prevent the melted metal from flowing away, is employed. The lead is poured on this table, and covered with grease to prevent oxidation of the surface. As soon as the lead is congealed, melted tin is poured over it, care being taken that the tin is sufficiently heated to remelt the surface of the lead and combine thoroughly with it. When the plate is sufficiently cooled, it is turned over, and the lower surface treated in the same way. The plate, thus tinned on both sides, is then placed between rollers, and can be rolled into very thin sheets without injury to the tin coating. These sheets, doubly coated with tin by this process, are specially adapted for lining cases intended for the transport of biscuits, chocolate, candies, tea, snuff, etc. If lead plates are only to be tinned superficially, they are heated to a tolerably high temperature, and sprinkled with powdered rosin; melted tin is then rubbed on the surface of the plate with a ball of tow. It is advisable to give the lead a fairly thick coating of tin, as the latter is rendered thinner by the subsequent rolling.

VARIOUS RECIPES:

To Ascertain whether an Article is Nickeled, Tinned, or Silvered.—When necessary to ascertain quickly and accurately the nature of the white metal covering an object, the following process will be found to give excellent results:

Nickeled Surface.—If the article has a nickel coating, a drop of hydrochloric acid, deposited on a spot clean and free from grease, will quickly develop a greenish tint. If the object is kept for 5 or 10 minutes in a solution composed of 60 parts of sea salt and 110 parts of water, it will receive a very characteristic reddish tint. A drop of sulphuret of sodium does not change a nickeled surface.

Tinned Surface.—A tinned object may be recognized readily by applying hydrochloric acid, which, even diluted, will remove the tin. The salt solution, used as previously described, produces a gray tint, faint in certain cases. The sulphuret of sodium dissolves tin.

Silvered Surface.—In the case of a silvered article a drop of nitric acid will remove the silver, while hydrochloric acid will scarcely attack it. The salt solution will produce no effect. The sulphuret of sodium will blacken it rapidly.

PLATINIZING:

See Plating.

PLATINOTYPE PAPER:

See Photography.

Polishes

POLISHES FOR AUTOMOBILES:

I.—Cedar Oil .....1 pound
Turpentine .....1 pint
Ammonia Water .....1 pint
Venice Turpentine ....2 ounces

Dissolve the venice turpentine in the turpentine and mix with the others. Apply with a soft cloth or sponge and polish with a dry cloth.

II.—Turpentine .....3 quarts
Kerosene .....2 gallons
Citronella Oil ..... half pint
Oil of Caraway Seeds
Sufficient to make six gallons

Neither Caraway oil or kerosene has any solvent properties as far as dissolving varnish gum is concerned; turpentine has, and there is just enough of it in this formula to make it "bite" without actually affecting the gloss prejudicially to any great extent.

III.—Boiled Linseed Oil...1 pound
Benzine .....1 quart
Cedar Oil .....6 ounces

Mix and apply with a sponge, running only one way of the paint. Let stand for half an hour and polish with a dry cloth.

IV.—Cheap Auto-Body Polish.—An excellent auto-body polish may be made very cheap. Buy a quart of paraffin flushing oil and add to it half a gallon of gasoline. The gasoline acts as a very effective cleaner and the paraffin gives the required lustre.

V.—Enamel (Black) for Auto.—

3 pints Good Varnish
3 quarts Turpentine
8 ounces best Japan dryer
1 ounce Carbon Black
1 ounce (commercial) Ether

Mix thoroughly the varnish and turpentine. Then add the other ingredients, mixing thoroughly by stirring. If another color is desired in place of black, use any other colored enamel.

Before applying, car should be washed thoroughly and allowed to dry. Apply mixture then with a piece of clean cheesecloth, go over the surface of the car once with the cheesecloth pressing lightly but not rubbing it. The mixture will spread and become even and smooth.

Polishes for Aluminum.—I.—M. Mouray recommends the use of an emulsion of equal parts of rum and olive oil, made by shaking these liquids together in a bottle. When a burnishing stone is used, the peculiar black streaks first appearing should not cause vexation, since they do not injure the metal in the least, and may be removed with a woolen rag. The object in question may also be brightened in potash lye, in which case, however, care must be taken not to have the lye too strong. For cleaning purposes benzol has been found best.

II.—Aluminum is susceptible of taking a beautiful polish, but it is not white like that of silver or nickel, rather slightly bluish, like tin. The shade can be improved. First, the grease is to be removed from the object with pumice stone. Then, for polishing, use is made of an emery paste mingled with tallow, forming cakes which are rubbed on the polishing brushes. Finally, rouge powder is employed with oil of turpentine.

POLISHES FOR BRASS, BRONZE, COPPER, ETC.:

Objects of polished copper, bronze, brass, and other alloys of copper tarnish through water and it is sometimes necessary to give them again their bright appearance. Pickle the articles in an acid bath; wash them next in a neutral bath; dry them, and subsequently rub them with a polishing powder. Such is the general formula; the processes indicated below are but variants adapted to divers cases and recommended by disinterested experimenters:

Sharp Polishes.—The following three may be used on dirty brasses, copper articles, etc., where scratching is not objectionable:

I.—Quartz, sand, powdered and levigated ..... 20 parts
Paris red ..... 30 parts
Vaseline ..... 50 parts
Mix intimately and make a pomade.

II.—Emery flour, finest levigated ..... 50 parts
Paris red ..... 50 parts
Mutton suet ..... 40 parts
Oleic acid ..... 40 parts

III.—Levigated emery powder .....100 parts
Anhydrous sodium carbonate ..... 5 parts
Tallow soap ..... 20 parts
Water .....100 parts

Copper Articles.—Make a mixture of powdered charcoal, very fine, 4 parts; spirit of wine, 3 parts; and essence of turpentine, 2 parts. To this add water in which one-third of its weight of sorrel salt or oxalic acid has been stirred, and rub the objects with this mixture.

Bronze Articles.—Boil the objects in soap lye, wash in plenty of water, and dry in sawdust.

Highly Oxidized Bronzes.—First dip in strong soda lye, then in a bath containing 1 part of sulphuric acid to 12 parts of water. Rinse in clean water, and next in water containing a little ammonia. Dry and rub with a polishing powder or paste.

POLISHES FOR FLOORS.

I.—Throw a handful of permanganate potash crystals into a pail of boiling water, and apply the mixture as hot as possible to the floor with a large flat brush. If the stain produced is not dark enough, apply one or two more coats as desired, leaving each wash to dry thoroughly before applying another. If it is desired to polish the surface with beeswax, a coat of size should be applied to the boards before staining, as this gives depth and richness to the color. After 3 or 4 days, polish well with a mixture of turpentine and beeswax. A few cents will cover the cost of both size and permanganate of potash.

II.—Potash.....	1 part
Water.....	4 parts
Yellow beeswax.....	5 parts
Hot water, a sufficient quantity.	

Emulsify the wax by boiling it in the water in which the potash has been dissolved; stir the whole time. The exact amount of boiling is determined by the absence of any free water in the mass. Then remove the vessel from the fire, and gently pour in a little boiling water, and stir the mixture carefully. If a fat-like mass appears without traces of watery particles, one may know the mass is in a fit condition to be liquefied by the addition of more hot water without the water separating. Then put in the water to the extent of 200 to 225 parts, and reheat the compound for 5 to 10 minutes, without allowing it to reach the boiling point. Stir constantly until the mixture is cool, so as to prevent the separation of the wax, when a cream-like mass results which gives a quick and brilliant polish on woodwork, if applied in the usual way, on a piece of flannel rag, and polished by rubbing with another piece of flannel.

Colored Floor Polishes.—Yellow: Caustic soda solution, 7½ parts, mixed with 1½ to 2 parts of finely powdered ocher, heated with 2½ parts of yellow wax, and stirred until uniformly mixed. A reddish-brown color may be obtained by adding 2 parts of powdered umber to the above mixture.

Nut Brown.—I.—Natural umber, ½ part; burnt umber, 1 part; and yellow ocher, 1 part, gives a fine red-brown color when incorporated with the same wax and soda mixture.

II.—Treat 5 pounds of wax with 15 pounds of caustic soda lye of 3° Bé. so that a uniform wax milk results; boil with ½ pound of annatto, 3 pounds of yellow ocher, and 2 pounds of burnt umber.

Mahogany Brown.—Boil 5 pounds of wax with 15 pounds of caustic soda lye as above. Then add 7 pounds of burnt umber very finely powdered, making it into a uniform mass by boiling again.

Yellow Ocher.—The wax milk obtained as above is boiled with 5 pounds of yellow ocher.

The mass on cooling has the consistency of a salve. If it is to be used for rubbing the floor it is stirred with sufficient boiling water so as to form a fluid of the consistency of thin syrup or oil. This is applied very thin on the floor, using a brush; then it is allowed to dry only half way, and is rubbed with a stiff floor brush. The polishing is continued with a woolen rag until a mirror-like gloss is obtained. It is best not to paint the whole room and then brush, but the deals should be taken one after the other, otherwise the coating would become too dry and give too dull a luster. The floors thus treated with gloss paste are very beautiful. To keep them in this condition they should be once in a while rubbed with a woolen rag, and if necessary the color has to be renewed in places. If there are parquet floors whose patterns are not to be covered up, the ocher (yellow) paste or, better still, the pure wax milk is used.

French Polish.—The wood to be polished must be made perfectly smooth and all irregularities removed from the surface with glass paper; next oil the work with linseed oil, taking care to rub off all superfluous oil. (If the wood is white no oil should be used, as it imparts a slight color.) Then prepare a wad or rubber of wadding, taking care there are no hard lumps in it. After the rubber is prepared pour on it a small quantity of polish. Then cover it with a piece of old cotton rag (new will

not answer). Put a small drop of oil with the finger on the surface of the rubber, and then proceed to polish, moving the rubber in lines, making a kind of figure of eight over the work. Be very careful that the rubber is not allowed to stick or the work will be spoilt. A little linseed oil facilitates the process. When the rubber requires more polish, turn back the rag cover, pour on the polish, replace the cover, oil and work as before. After this rubbing has proceeded for a little time and the whole surface has been gone over, the work must be allowed to stand for a few hours to harden, and then be rubbed down smooth with very fine emery paper. Then give another coat of polish. If not smooth enough, emery paper again. This process must continue until the grain is filled up. Finish off with a clean rubber with only spirit on it (no polish), when a clear bright surface should be the result. Great care must be taken not to put the polish on too freely, or you will get a rough surface. After a little practice all difficulties will vanish. The best French polish will be found to be one made only from good pale orange shellac and spirit, using 3 pounds of shellac for each gallon of spirit. The latter should be of 63 to 64° over-proof. A weak spirit is not suitable and does not make a good polish. A few drops of pure linseed oil make the polish work more freely.

POLISHES FOR FURNITURE.

First make a paste to fill cracks as follows: Whiting, plaster of Paris, pumice stone, litharge, equal parts; japan dryer, boiled linseed oil, turpentine, coloring matter of sufficient quantity. Rub the solids intimately with a mixture of 1 part of the japan, 2 parts of the linseed oil, and 3 parts of turpentine, coloring to suit with Vandyke brown or sienna. Lay the filling on with a brush, let it set for about 20 minutes, and then rub off clean except where it is to remain. In 2 or 3 days it will be hard enough to polish.

After the surface has been thus prepared, the application of a coat of first-class copal varnish is in order. It is recommended that the varnish be applied in a moderately warm room, as it is injured by becoming chilled in drying. To get the best results in varnishing, some skill and experience are required. The varnish must be kept in an evenly warm temperature, and put on neither too plentifully nor too gingerly.

After a satisfactorily smooth and regular surface has been obtained, the polishing proper may be done. This may be accomplished by manual labor and dexterity, or consist in the application of a very thin, even coat of a very fine, transparent varnish.

If the hand-polishing method be preferred, it may be pursued by rubbing briskly and thoroughly with the following finishing polish:

I.—Alcohol	8 ounces
Shellac	2 drachms
Gum benzoin	2 drachms
Best poppy oil	2 drachms

Dissolve the shellac and gum in the alcohol in a warm place, with frequent agitation, and, when cold, add the poppy oil. This may be applied on the end of a cylindrical rubber made by tightly rolling a piece of flannel which has been torn, not cut, into strips 4 to 6 inches wide.

A certain "oily sweating" of articles of polished wood occurs which has been ascribed to the oil used in polishing, but has been found to be due to a waxy substance present in shellac, which is often used in polishing. During the operation of polishing, this wax enters into close combination with the oil, forming a soft, greasy mass, which prevents the varnish from ever becoming really hard. This greasy matter exudes in the course of time. The remedy is to use only shellac from which the vegetable wax has been completely removed. This is accomplished by making a strong solution of the shellac in alcohol and then shaking it up with fresh seed lac or filtering it through seed lac. In this way the readily soluble rosins in the seed lac are dissolved, and with them traces of coloring matter. At the same time the vegetable wax, which is only slightly soluble, is deposited. The shellac solution which has exchanged its vegetable wax for rosin is not yet suitable for fine furniture polishing. It is not sufficiently taken up by the wood, and an essential oil must be added to give it the necessary properties, one of the best oils to employ for this purpose being that of rosemary. The following recipe is given:

II.—Twenty pounds of shellac and 4 pounds of benzoin are dissolved in the smallest possible quantity of alcohol, together with 1 pound of rosemary oil. The solution then obtained is filtered through seed lac so as to remove whatever vegetable wax may be present.

Red Furniture Paste.—

Soft water	6 pints
Turpentine	6 pints

Beeswax	3 pounds
White wax	1½ ounces
White soap	18 ounces
Red lead	12 ounces

Cut up soap and dissolve in water by aid of heat; then evaporate to 6 pounds. Melt the waxes and add turpentine in which red lead has been stirred, pour into this the soap solution, and stir until it is nearly cold. If a darker color is wanted add more red lead, 4 to 6 ounces.

Beechwood Furniture.—The wood of the red beech is known to acquire, by the use of ordinary shellac polish, a dirty yellow color, and by the use of white polish, prepared from bleached shellac, an unsightly gray-white color. Therefore, where light colors are desired, only filtered shellac polish should be employed, and in order to impart some fire to the naturally dull color of the beechwood the admixture of a solution of dragon's blood in alcohol for a red shade, or turmeric in alcohol for yellow may be used. A compound of the red and yellow liquids gives a good orange shade. A few trials will soon show how much coloring matter may be added to the polish.

Polishes for Glass.—I.—Mix calcined magnesia with purified benzine to a semiliquid paste. Rub the glass with this mixture by means of a cotton wad, until it is bright.

II.—Crush to powder cologne chalk, 60 parts, by weight; tripoli, 30 parts, by weight; bole, 15 parts, by weight. For use moisten the glass a little, dip a linen rag into the powder and rub the glass until it is clean.

III.—Tin ashes may be employed with advantage. The glass is rubbed with this substance and then washed off with a piece of soft felt. In this manner a very handsome polish is obtained.

Polishes for Ivory, Bone, etc.—I.—First rub with a piece of linen soaked with a paste made of Armenian bole and oleic acid. Wash with Marseilles soap, dry, rub with a chamois skin, and finally render it bright with an old piece of silk. If the ivory is scratched, it may be smoothed by means of English red stuff on a cloth, or even with a piece of glass if the scratches are rather deep. In the hollow parts of ivory objects the paste can be made to penetrate by means of an old toothbrush.

II.—Tortoise-shell articles have a way of getting dull and dingy looking. To repolish dip the finger in linseed oil and rub over the whole surface. Very little oil should be used, and if the article is a patterned one it may be necessary to use a soft brush to get it into the crevices. Then rub with the palm of the hand until all oil has disappeared, and the shell feels hot and looks bright and shiny.

Marble Polishing.—Polishing includes five operations. Smoothing the roughness left on the surface is done by rubbing the marble with a piece of moist sandstone; for moldings either wooden or iron mullers are used, crushed, and wet sandstone, or sand, more or less fine, according to the degree of polish required, being thrown under them. The second process is continued rubbing with pieces of pottery without enamel, which have only been baked once, also wet. If a brilliant polish is required, Gothland stone instead of pottery is used, and potter's clay or fuller's earth is placed beneath the muller. This operation is performed upon granites and porphyry with emery and a lead muller, the upper part of which is incrusted with the mixture until reduced by friction to clay or impalpable powder. As the polish depends almost entirely upon these two operations, care must be taken that they are performed with a regular and steady movement. When the marble has received the first polish, the flaws, cavities, and soft spots are sought out and filled with mastic of a suitable color.

This mastic is usually composed of a mixture of yellow wax, rosin, and Burgundy pitch, mixed with a little sulphur and plaster passed through a fine sieve, which gives it the consistency of a thick paste; to color this paste to a tone analogous to the ground tints or natural cement of the material upon which it is placed, lampblack and rouge, with a little of the prevailing color of the material, are added. For green and red marbles, this mastic is sometimes made of gum lac, mixed with Spanish sealing wax of the color of the marble. It is applied with pincers, and these parts are polished with the rest. Sometimes crushed fragments of marble are introduced into the cement, but for fine marbles the same colors are employed which are used in painting, and which will produce the same tone as the ground; the gum lac is added to give it body and brilliancy.

The third operation in polishing consists in rubbing it again with a hard pumice stone, under which water is being constantly poured, unmixed with sand. For the fourth process, called

softening the ground, lead filings are mixed with the emery mud produced by the polishing of mirrors or the working of precious stones, and the marble is rubbed by a compact linen cushion well saturated with this mixture; rouge is also used for this polish. For some outside works, and for hearths and paving tiles, marble workers confine themselves to this polish. When the marbles have holes or grains, a lead muller is substituted for the linen cushion. In order to give a perfect brilliancy to the polish, the gloss is applied. Wash well the prepared surfaces and leave them until perfectly dry, then take a linen cushion, moistened only with water, and a little powder of calcined tin of the first quality. After rubbing with this for some time take another cushion of dry rags, rub with it lightly, brush away any foreign substance which might scratch the marble, and a perfect polish will be obtained. A little alum mixed with the water used penetrates the pores of the marble, and gives it a speedier polish. This polish spots very easily and is soon tarnished and destroyed by dampness. It is necessary when purchasing articles of polished marbles to subject them to the test of water; if there is too much alum, the marble absorbs the water and a whitish spot is left.

POLISHING POWDERS.

Polishing powders are advantageously prepared according to the following recipes:

I.—Four pounds magnesium carbonate, 4 pounds chalk, and 4 pounds rouge are intimately mixed.

II.—Four pounds magnesium carbonate are mixed with ¼ pound fine rouge.

III.—Five pounds fine levigated whiting and 2 pounds Venetian red are ground together.

IV.—Kieselguhr	42	pounds
Putty powder	14	pounds
Pipe clay	14	pounds
Tartaric acid	1½	pounds

Powder the acid, mix well with the others. This is styled "free from mercury, poisonous mineral acids, alkalies, or grit." It may be tinted with 12 ounces of oxide of iron if desired.

Liquid Polishes.—

I.—Malt vinegar	4	gallons
Lemon juice	1	gallon
Paraffine oil	1	gallon
Kieselguhr	7	pounds
Powdered bath brick	3	pounds
Oil lemon	2	ounces

II.—Kieselguhr	56	pounds
Paraffine oil	3	gallons
Methylated spirit	1½	gallons
Camphorated spirit	½	gallon
Turpentine oil	½	gallon
Liquid ammonia fort	3	pints

III.—Rotten stone	16	av. ounces
Paraffine	8	av. ounces
Kerosene (coal oil)	16	fluidounces
Oil of mirbane enough to perfume.		

Melt the paraffine, incorporate the rotten stone, add the kerosene, and the oil of mirbane when cold.

IV.—Oxalic acid	½	av. ounce
Rotten stone	10	av. ounces
Kerosene (coal oil)	30	fluidounces
Paraffine	2	av. ounces

Pulverize the oxalic acid and mix it with rotten stone; melt the paraffine, add to it the kerosene, and incorporate the powder; when cool, add oil of mirbane or lavender to perfume.

Pour the ammonia into the oil, methylated spirits, and turpentine, add the camphorated spirit and mix with the kieselguhr. To prevent setting, keep well agitated during filling. The color may be turned red by using a little sesquioxide of iron and less kieselguhr. Apply with a cloth, and when dry use another clean cloth or a brush.

Polishing Soaps.—

I.—Powdered pipe clay	112	pounds
Tallow soap	16	pounds
Tartaric acid	1¼	pounds

Grind until pasty, afterwards press into blocks by the machine.

II.—Levigated flint	60	pounds
Whiting	52	pounds
Tallow	20	pounds
Caustic soda	5	pounds
Water	2	gallons

Dissolve the soda in water and add to the tallow; when saponified, stir in the others, pressing as before.

VI.—Saponified cocoanut oil	56	pounds
Kieselguhr	12	pounds
Alum	5¼	pounds
Flake white	5½	pounds
Tartaric acid	1¾	pounds

Make as before.

IV.—Tallow soap	98	pounds
Liquid glycerine soap	14	pounds
Whiting	18	pounds
Levigated flint	14	pounds
Powdered pipe clay	14	pounds

METAL POLISHES:

Polishing Pastes.—

I.—White petroleum jelly	90 pounds
Kieselguhr	30 pounds
Refined paraffine wax	10 pounds
Refined chalk or whiting	10 pounds
Sodium hyposulphite	8 pounds

Melt wax and jelly, stir in others and grind.

It is an undecided point as to whether a scented paste is better than one without perfume. The latter is added merely to hide the nasty smell of some of the greases used, and it is not very nice to have spoons, etc., smelling, even tasting, of mirbane, so perhaps citronelle is best for this purpose. It is likely to be more pure. The dose of scent is usually at the rate of 4 ounces to the hundredweight.

II.—Dehydrated soda	5 parts
Curd soap	20 parts
Emery flour	100 parts

To be stirred together on a water bath with water, 100 parts, until soft.

III.—Turpentine	1 part
Emery flour	1 part
Paris red	2 parts
Vaseline	2 parts

Mix well and perfume.

IV.—Stearine	8 to 9 parts
Mutton suet	32 to 38 parts
Stearine oil	2 to 2.5 parts

Melt together and mix with Vienna chalk, in fine powder, 48 to 60 parts; Paris red, 20 parts.

V.—Rotten stone	1 part
Iron subcarbonate	3 parts
Lard oil, a sufficient quantity.	

VI.—Iron oxide	10 parts
Pumice stone	32 parts
Oleic acid, a sufficient quantity.	

VII.—Soap, cut fine	16 parts
Precipitated chalk	2 parts
Jewelers' rouge	1 part
Cream of tartar	1 part
Magnesium carbonate	1 part
Water, a sufficient quantity.	

Dissolve the soap in the smallest quantity of water over a water bath. Add the other ingredients to the solution while still hot, stirring all the time to make sure of complete homogeneity. Pour the mass into a box with shallow sides, and afterwards cut into cubes.

Non-Explosive Liquid Metal Polish.—Although in a liquid form, it does not necessarily follow that a liquid polish is less economical than pastes, because the efficiency of both is dependent upon the amount of stearic or oleic acid they contain, and a liquid such as that given below is as rich in this respect as most of the pastes, especially those containing much mineral jelly and earthy matters which are practically inert, and can only be considered as filling material. Thus it is a fact that an ounce of fluid polish may possess more polishing potency than an equal weight of the paste. Proportions are: Sixteen pounds crude oleic acid; 4 pounds tasteless mineral oil; 5 pounds kieselguhr; 1½ ounces lemon oil. Make the earthy matter into a paste with the mixed fluids and gradually thin out, avoiding lumps. Apply with one rag, and finish with another.

Miscellaneous Metal Polishes.—I.—Articles of polished copper, such as clocks, stove ornaments, etc., become tarnished very quickly. To restore their brilliancy dip a brush in strong vinegar and brush the objects to be cleaned. Next pass through water and dry in sawdust. A soap water, in which some carbonate of soda has been dissolved, will do the same service.

II.—This is recommended for machinery by the chemical laboratory of the industrial museum of Batavia:

Oil of turpentine	15 parts
Oil of stearine	25 parts
Jewelers' red	25 parts
Animal charcoal, of superior quality	45 parts

Alcohol is added to that mixture in such a quantity as to render it almost liquid, then by means of a brush it is put on those parts that are to be polished. When the alcohol has dried, the remaining cover is rubbed with a mixture of 45 parts of animal charcoal and 25 parts jewelers' red. The rubbed parts will become quite clean and bright.

III.—The ugly spots which frequently show themselves on nickel-plated objects may be easily removed with a mixture of 1 part sulphuric acid and 50 parts alcohol. Coat the spots with this solution, wipe off after a few seconds, rinse off thoroughly with clean water, and rub dry with sawdust.

IV.—Crocus, dried and powdered, when applied with chamois leather to nickel-plated goods, will restore their brilliancy without injuring their surface.

V.—Articles of tin should be ground

and polished with Vienna lime or Spanish white. The former may be spread on linen rags, the latter on wash leather. Good results may be obtained by a mixture of about equal parts of Vienna lime, chalk, and tripoli. It should be moistened with alcohol, and applied with a brush. Subsequent rubbing with roe skin (chamois) will produce a first-rate polish. Tin being a soft metal, the above polishing substances may be very fine.

VI.—To polish watch cases, take two glasses with large openings, preferably two preserving jars with ground glass covers. Into one of the glass vessels pour 1 part of spirit of sal ammoniac and 3 parts water, adding a little ordinary barrel soap and stirring everything well. Fill the other glass one half with alcohol. Now lay the case to be cleaned, with springs and all, into the first-named liquid and allow to remain therein for about 10 to 20 seconds. After protracted use this time may be extended to several minutes. Now remove the case, quickly brush it with water and soap and lay for a moment into the alcohol in the second vessel. After drying off with a clean cloth heat over a soldering flame for quick drying and the case will now look almost as clean and neat as a new one. The only thing that may occur is that a polished metal dome may become tarnished, but this will only happen if either the mixture is too strong or the case remains in it too long, both of which can be easily avoided with a little practice. Shake before using.

VII.—This is a cleanser as well as polisher:

Prepared chalk	2 parts
Water of ammonia	2 parts
Water sufficient to make	8 parts

The ammonia saponifies the grease usually present.

It must be pointed out that the alkali present makes this preparation somewhat undesirable to handle, as it will affect the skin if allowed too free contact.

The density of the liquid might be increased by the addition of soap; the solid would, of course, then remain longer in suspension.

VIII.—Serviettes Magiques.—These fabrics for polishing articles of metal consist of pure wool saturated with soap and tripoli, and dyed with a little coralline. They are produced by dissolving 4 parts of Marseilles soap in 20 parts of water, adding 2 parts of tripoli and saturating a piece of cloth 3 inches long and 4 inches wide with it, allowing to dry.

IX.—In order to easily produce a mat polish on small steel articles use fine powdered oil stone, ground with turpentine.

Polishes for Pianos.—

I.—

Alcohol, 95 per cent	300 parts
Benzol	700 parts
Gum benzoin	8 parts
Sandarac	16 parts

Mix and dissolve. Use as French polish.

II.—

Beeswax	2,500 parts
Potassium carbonate	25 parts
Oil of turpentine	4,000 parts
Water, rain or distilled	4,500 parts

Dissolve the potassium carbonate in 1,500 parts of the water and in the solution boil the wax, shaved up, until the latter is partially saponified, replacing the water as it is driven off by evaporation. When this occurs remove from the fire and stir until cold. Now add the turpentine little by little, and under constant agitation, stirring until a smooth, homogeneous emulsion is formed. When this occurs add the remainder of the water under constant stirring. If a color is wanted use alkanet root, letting it macerate in the oil of turpentine before using the latter (about an ounce to the quart is sufficient). This preparation is said to be one of the best polishes known. The directions are very simple: First wash the surface to be polished, rinse, and dry. Apply the paste as evenly and thinly as possible over a portion of the surface, then rub off well with a soft woolen cloth.

Polishes for Silverware.—The best polish for silverware—that is, the polish that, while it cleans, does not too rapidly abrade the surface—is levigated chalk, either alone or with some vegetable acid, like tartaric, or with alum. The usual metal polishes, such as tripoli (diatomaceous earth), finely ground pumice stone, etc., cut away the surface so rapidly that a few cleanings wear through ordinary plating.

I.—

White lead	5 parts
Chalk, levigated	20 parts
Magnesium carbonate	2 parts
Aluminum oxide	5 parts
Silica	3 parts
Jewelers' rouge	2 parts

Each of the ingredients must be reduced to an impalpable powder, mixed carefully, and sifted through silk several

times to secure a perfect mixture, and to avoid any possibility of leaving in the powder anything that might scratch the silver or gold surface. This may be left in the powder form, or incorporated with soap, made into a paste with glycerine, or other similar material. The objection to mixtures with vaseline or greasy substances is that after cleaning the object must be scrubbed with soap and water, while with glycerine simple rinsing and running water instantly cleans the object. The following is also a good formula:

II.—Chalk, levigated....	2 parts
Oil of turpentine....	4 parts
Stronger ammonia water.....	4 parts
Water.....	10 parts

Mix the ammonia and oil of turpentine by agitation, and rub up the chalk in the mixture. Finally rub in the water gradually or mix by agitation. Three parts each of powdered tartaric acid and chalk with 1 part of powdered alum make a cheap and quick silver cleaning powder.

III.—Mix 2 parts of beechwood ashes with $\frac{1}{100}$ of a part of Venetian soap and 2 parts of common salt in 8 parts of rain water. Brush the silver with this, using a pretty stiff brush. A solution of crystallized permanganate of potash is often recommended, or even the spirits of hartshorn, for removing the grayish violet film which forms upon the surface of the silver. Finally, when there are well-determined blemishes upon the surface of the silver, they may be soaked 4 hours in soapmakers' lye, then cover them with finely powdered gypsum which has been previously moistened with vinegar, drying well before a fire; now rub them with something to remove the powder. Finally, they are to be rubbed again with very dry bran.

POLISHES FOR STEEL AND IRON.

The polishing of steel must always be preceded by a thorough smoothing, either with oilstone dust, fine emery, or coarse rouge. If any lines are left to be erased by means of fine rouge, the operation becomes tedious and is rarely successful. The oilstone dust is applied on an iron or copper polisher. When it is desired to preserve the angles sharp, at a shoulder, for instance, the polisher should be of steel. When using diamantine an iron polisher, drawn out and flattened with a hammer, answers very well. With fine rouge, a bronze or bell-metal polisher is preferable for shoulders; and for flat surfaces, discs or large zinc or tin polishers, although glass is preferable to either of these. After each operation with oilstone dust, coarse rouge, etc., the polisher, cork, etc., must be changed, and the object should be cleaned well, preferably by soaping, perfect cleanliness being essential to success. Fine rouge or diamantine should be made into a thick paste with oil; a little is then taken on the polisher or glass and worked until quite dry. As the object is thus not smeared over, a black polish is more readily obtained, and the process gets on better if the surface be cleaned from time to time.

For Fine Steel.—Take equal parts (by weight) of ferrous sulphate—green vitriol—and sodium chloride—cooking salt—mix both well together by grinding in a mortar and subject the mixture to red heat in a mortar or a dish. Strong fumes will develop, and the mass begin to flow. When no more fumes arise, the vessel is removed from the fire and allowed to cool. A brown substance is obtained with shimmering scales, resembling mica. The mass is now treated with water, partly in order to remove the soluble salt, partly in order to wash out the lighter portions of the non-crystallized oxide, which yield an excellent polishing powder. The fire must be neither too strong nor too long continued, otherwise the powder turns black and very hard, losing its good qualities. The more distinct the violet-brown color, the better is the powder.

For polishing and cleaning fenders, fireirons, horses' bits, and similar articles: Fifty-six pounds Bridgewater stone; 28 pounds flour emery; 20 pounds rotten stone; 8 pounds whiting. Grind and mix well.

To make iron take a bright polish like steel, pulverize and dissolve in 1 quart of hot water, 1 ounce of blue vitriol; 1 ounce of borax; 1 ounce of prussiate of potash; 1 ounce of charcoal; $\frac{1}{2}$ pint of salt, all of which is to be added to one gallon of linseed oil and thoroughly mixed. To apply, bring the iron or steel to the proper heat and cool in the solution.

Stove Polish.—The following makes an excellent graphite polish:

I.—Ceresine.....	12 parts
Japan wax.....	10 parts
Turpentine oil.....	100 parts
Lampblack, best...	12 parts
Graphite, levigated	10 parts

Melt the ceresine and wax together, remove from the fire, and when half

cooled off add and stir in the graphite and lampblack, previously mixed with the turpentine.

II.—Ceresine	23	parts
Carnauba wax	5	parts
Turpentine oil	220	parts
Lampblack	300	parts
Graphite, finest levigated	25	parts

Mix as above.

III.—Make a mixture of water glass and lampblack of about the consistency of thin syrup, and another of finely levigated plumbago and mucilage of Soudan gum (or other cheap substitute for gum arabic), of a similar consistency. After getting rid of dust, etc., go over the stove with mixture No. I and let it dry on, which it will do in about 24 hours. Now go over the stove with the second mixture, a portion of the surface at a time, and as this dries, with an old blacking brush give it a polish. If carefully done the stove will have a polish resembling closely that of new Russian iron. A variant of this formula is as follows: Mix the graphite with the water glass to a smooth paste; add, for each pound of paste, 1 ounce of glycerine and a few grains of aniline black. Apply to the stove with a stiff brush.

POLISHES FOR WOOD:

See also Polishes for Furniture, Floors and Pianos.

In the usual method of French polishing, the pad must be applied along curved lines, and with very slight pressure, if the result is to be uniform. To do this requires much practice and the work is necessarily slow. Another disadvantage is that the oil is apt to sweat out afterwards, necessitating further treatment. According to a German patent all difficulty can be avoided by placing between the rubber and its covering a powder composed of clay or loam, or better, the powder obtained by grinding fragments of terra cotta or of yellow bricks. The powder is moistened with oil for use. The rubber will then give a fine polish, without any special delicacy of manipulation and with mere backward and forward rubbing in straight lines, and the oil will not sweat out subsequently. Another advantage is that no priming is wanted, as the powder fills up the pores. The presence of the powder also makes the polish adhere more firmly to the wood.

Oak Wood Polish.—The wood is first carefully smoothed, then painted with the following rather thickly liquid mass, using a brush, viz.: Mix 1½ parts, by weight, of finely washed chalk (whiting), ½ part of dryer, and 1 part of boiled linseed oil with benzine and tint (umber with a little lampblack, burnt sienna). After the applied mixture has become dry, rub it down, polish with glass powder, and once more coat with the same mixture. After this filling and after rubbing off with stickwood chips or fine sea grass, one or two coats of shellac are put on (white shellac with wood alcohol for oak, brown shellac for cherry and walnut). This coating is cut down with sandpaper and given a coat of varnish, either polishing varnish, which is polished off with the ball of the hand or a soft brush, or with interior varnish, which is rubbed down with oil and pumice stone. This polish is glass hard, transparent, of finer luster, and resistive.

Hard Wood Polish.—In finishing hard wood with a wax polish the wood is first coated with a "filler," which is omitted in the case of soft wood. The filler is made from some hard substance, very finely ground; sand is used by some manufactures.

The polish is the same as for soft wood. The simplest method of applying wax is by a heated iron, scraping off the surplus, and then rubbing with a cloth. It is evident that this method is especially laborious; and for that reason solution of the wax is desirable. It may be dissolved rather freely in turpentine spirit, and is said to be soluble also in kerosene oil.

The following recipes give varnish-like polishes:

I.—Dissolve 15 parts of shellac and 15 parts of sandarac in 180 parts of spirit of wine. Of this liquid put some on a ball of cloth waste and cover with white linen moistened with raw linseed oil. The wood to be polished is rubbed with this by the well-known circular motion. When the wood has absorbed sufficient polish, a little spirit of wine is added to the polish, and the rubbing is continued. The polished articles are said to sustain no damage by water, nor show spots or cracks.

II.—Orange shellac, 3 parts; sandarac, 1 part; dissolved in 30 parts of alcohol. For mahogany add a little dragon's blood.

III.—Fifteen parts of oil of turpentine, dyed with anchusine, or undyed, and 4 parts of scraped yellow wax are stirred into a uniform mass by heating on the water bath.

IV.—Melt 1 part of white wax on the water bath, and add 8 parts of petroleum. The mixture is applied hot. The petroleum evaporates and leaves behind a thin layer of wax, which is subsequently rubbed out lightly with a dry cloth rag.

V.—Stearine	100 parts
Yellow wax	25 parts
Caustic potash	60 parts
Yellow laundry soap	10 parts
Water, a sufficient quantity.	

Heat together until a homogeneous mixture is formed.

VI.—Yellow wax	25 parts
Yellow laundry soap	6 parts
Glue	12 parts
Soda ash	25 parts
Water, a sufficient quantity.	

Dissolve the soda in 400 parts of water, add the wax, and boil down to 250 parts, then add the soap. Dissolve the glue in 100 parts of hot water, and mix the whole with the saponified wax.

VII.—This is waterproof. Put into a stoppered bottle 1 pint alcohol; 2 ounces gum benzoin; ¼ ounce gum sandarac, and ¼ ounce gum anime. Put the bottle in a sand bath or in hot water till the solids are dissolved, then strain the solution, and add ¼ gill best clear poppy oil. Shake well and the polish is ready for use.

VIII.—A white polish for wood is made as follows:

White lac	1½ pounds
Powdered borax	1 ounce
Alcohol	3 pints

The lac should be thoroughly dried, especially if it has been kept under water, and, in any case, after being crushed, it should be left in a warm place for a few hours, in order to remove every trace of moisture. The crushed lac and borax are then added to the spirit, and the mixture is stirred frequently until solution is effected, after which the polish should be strained through muslin.

IX.—To restore the gloss of polished wood which has sweated, prepare a mixture of 100 parts of linseed oil, 750 parts of ether, 1,000 parts of rectified oil of turpentine, and 1,000 parts of petroleum benzine, perfumed, if desired, with a strongly odorous essential oil, and colored, if required, with cuicuma, orlean, or alkanna. The objects to be treated are rubbed thoroughly with this mixture, using a woolen rag.

MISCELLANEOUS POLISHING AGENTS:

Polishing Agent which may also be used for Gilding and Silvering.—The following mediums hitherto known as possessing the aforenamed properties, lose these qualities upon having been kept for some time, as the metal salt is partly reduced. Furthermore, it has not been possible to admix reducing substances such as zinc to these former polishing agents, since moisture causes the metal to precipitate. The present invention obviates these evils. The silver or gold salt is mixed with chalk, for instance, in a dry form. To this mixture, fine dry powders of one or more salts (e. g., ammonia compounds) in whose solutions the metal salt can enter are added; if required, a reducing body, such as zinc, may be added at the same time. The composition is pressed firmly together and forms briquettes, in which condition the mass keeps well. For use, all that is necessary is to scrape off a little of the substance and to prepare it with water.

Silver Polishing Balls.—This polishing agent is a powder made into balls by means of a binding medium and enjoys much popularity in Germany. It is prepared by adding 5 parts of levigated chalk to 2 parts of yellow tripoli, mixing the two powders well and making into a stiff paste with very weak gum water —1 part gum arabic to 12 parts of water. This dough is finally shaped by hand into balls of the size of a pigeon's egg. The balls are put aside to dry on boards in a moderately warm room, and when completely hard are wrapped in tin-foil paper.

POLISHING CLOTH:

For preparing a polishing cloth the United States Bureau of Standards recommends the following:

A mineral oil or paraffin wax is dissolved in gasoline, and an abrasive such as infusorial earth is thoroughly mixed in with the liquid. A cloth which may be of cotton, wool or silk so woven as to be soft is passed through the mixture and then stretched and allowed to dry.

A dust-cloth is made in a similar way, omitting the abrasive and when dry rubbed on a wooden surface until it no longer streaks.

To Polish Delicate Objects.—Rub the objects with a sponge charged with a mixture of 28 parts of alcohol, 14 parts of water, and 4 parts of lavender oil.

Polish for Gilt Frames.—Mix and beat the whites of 3 eggs with one-third, by weight, of javelle water, and apply to the gilt work.

Steel Dust as a Polishing Agent.—Steel dust is well adapted for polishing precious stones and can replace emery with advantage. It is obtained by spraying water on a bar of steel brought to a high temperature. The metal becomes friable and can be readily reduced to powder in a mortar. This powder is distinguished from emery by its mordanting properties and its lower price. Besides, it produces a finer, and consequently, a more durable polish.

Polishing Bricks.—Stir into a thick pulp with water 10 parts of finely powdered and washed chalk, 1 part of English red, and 2 parts of powdered gypsum; give it a square shape and dry.

Polishing Cream.—

Denaturized alcohol	400 parts
Spirit of sal ammoniac	75 parts
Water	150 parts
Petroleum ether	80 parts
Infusorial earth	100 parts
Red bole or white bole	50 parts
Calcium carbonate	100 parts

Add as much of the powders as desired. Mirbane oil may be used for scenting.

Polishing Paste.—

Infusorial earth (Kieselguhr)	8 ounces
Paraffine	2 ounces
Lubricating oil	6 fluidounces
Oleic acid	1 fluidounce
Oil mirbane	30 minims

Melt the paraffine with the lubricating oil, and mix with the infusorial earth, then add the oleic acid and oil of mirbane.

To Polish Paintings on Wood.—According to the statements of able cabinet makers who frequently had occasion to cover decorations on wood, especially aquarelle painting, with a polish, a good coating of fine white varnish is the first necessity, dammar varnish being employed for this purpose. This coat is primarily necessary as a protective layer so as to preserve the painted work from destructive attacks during the rubbing for the production of a smooth surface and the subsequent polishing. At all events, the purest white polishing varnish must be used for the polish so as to prevent a perceptible subsequent darkening of the white painting colors. Naturally the success here is also dependent upon the skill of the polisher. To polish painting executed on wood it is necessary to choose a white, dense, fine grained wood, which must present a well-smoothed surface before the painting. After the painting the surface is faintly coated with a fine, quickly drying, limpid varnish. When the coating has dried well, it is carefully rubbed down with finely pulverized pumice stone, with tallow or white lard, and now this surface is polished in the usual manner with a good solution prepared from the best white shellac.

Polishing Mediums.—For iron and steel, stannic oxide or Vienna lime or iron oxide and sometimes steel powder is employed. In using the burnisher, first oil is taken, then soap water, and next Vienna lime.

For copper, brass, German silver, and tombac, stearine oil and Vienna lime are used. Articles of brass can be polished, after the pickling, in the lathe with employment of a polish consisting of shellac, dissolved in alcohol, 1,000 parts; powdered turmeric, 1,000 parts; tartar, 2,000 parts; ox gall, 50 parts; water, 3,000 parts.

Gold is polished with ferric oxide (red stuff), which, moistened with alcohol, is applied to leather.

For polishing silver, the burnisher or bloodstone is employed, using soap water, thin beer, or a decoction of soap wort. Silver-plated articles are also polished with Vienna lime.

To produce a dull luster on gold and silver ware, glass brushes, i. e., scratch brushes of finely spun glass threads, are made use of.

Pewter articles are polished with Vienna lime or whiting; the former on a linen rag, the latter on leather.

If embossed articles are to be polished, use the burnisher, and for polish, soap water, soap-wort decoction, ox gall with water.

Antimony-lead alloys are polished with burnt magnesia on soft leather or with fine jewelers' red.

Zinc is brightened with Vienna lime or powdered charcoal.

Vienna lime gives a light-colored polish on brass, while ferric oxide imparts a dark luster.

Diatomaceous or infusorial earth is an excellent abrasive powder to use for polishing and cleaning enamelware, sinks, bathtubs, glass, metals, woodwork, tiles, marble, etc. This material can also be used for preparing and polishing metal surfaces for microscopical examination.

Rouge or Paris Red.—This appears in commerce in many shades, varying from brick red to chocolate brown. The color, however, is in no wise indicative of its purity or good quality, but it can be accepted as a criterion by which to determine the hardness of the powder. The darker the powder, the greater is its degree of hardness; the red or reddish is always very soft, wherefore the former is used for polishing steel and the latter for softer metals.

For the most part, Paris red consists of ferric oxide or ferrous oxide. In its production advantage is taken of a peculiarity common to most salts of iron, that when heated to a red heat they separate the iron oxide from the acid combination. In its manufacture it is usual to take commercial green vitriol, copperas crystals, and subject them to a moderate heat to drive off the water of crystallization. When this is nearly accomplished they will settle down in a white powder, which is now placed in a crucible and raised to a glowing red heat till no more vapor arises, when the residue will be found a soft smooth red powder. As the temperature is raised in the crucible, the darker will become the color of the powder and the harder the abrasive.

Should an especially pure rouge be desired, it may be made so by boiling the powder we have just made in a weak solution of soda and afterwards washing it out repeatedly and thoroughly with clean water. If treated in this way, all the impurities that may chance to stick to the iron oxide will be separated from it.

Should a rouge be needed to put a specially brilliant polish upon any object its manufacture ought to be conducted according to the following formula: Dissolve commercial green vitriol in water; dissolve also a like weight of sorrel salt in water; filter both solutions; mix them well, and warm to 140° F.; a yellow precipitate, which on account of its weight, will settle immediately; decant the fluid, dry out the residue, and afterwards heat it as before in an iron dish in a moderately hot furnace till it glows red.

By this process an exceptionally smooth, deep-red powder is obtained, which, if proper care has been exercised in the various steps, will need no elutriation, but can be used for polishing at once. With powders prepared in this wise our optical glasses and lenses of finest quality are polished.

POLISHES FOR THE LAUNDRY:
See Laundry Preparations.

POMEGRANATE ESSENCE:
See Essences and Extracts.

PORCELAIN:
See also Ceramics.

Mending Porcelain by Riveting (see Adhesives for methods of mending Porcelain by means of cements).—Porcelain and glass can be readily pierced with steel tools. Best suited are hardened drills of ordinary shape, moistened with oil of turpentine, if the glazed or vitreous body is to be pierced. In the case of majolica and glass without enamel the purpose is best reached if the drilling is done under water. Thus, the vessel should previously be filled with water, and placed in a receptacle containing water, so that the drill is used under water, and, after piercing the clay body, reaches the water again. In the case of objects glazed on the inside, instead of filling them with water, the spot where the drill must come through may be underlaid with cork. The pressure with which the drill is worked is determined by the hardness of the material, but when the tool is about to reach the other side it should gradually decrease and finally cease almost altogether, so as to avoid chipping. In order to enlarge small bore holes already existing, three-cornered or four-square broaches, ground and polished, are best adapted. These are likewise employed under water or, if the material is too hard (glass or enamel), moistened with oil of turpentine. The simultaneous use of oil of turpentine and water is most advisable in all cases, even where the nature of the article to be pierced does not admit the use of oil alone, as in the case of majolica and non-glazed porcelain, which absorb the oil, without the use of water.

Porcelain Decoration.—A brilliant yellow color, known as "gold luster," may be produced on porcelain by the use of paint prepared as follows: Melt over a sand bath 30 parts of rosin, add 10 parts of uranic nitrate, and, while constantly stirring, incorporate with the liquid 35 to 40 parts of oil of lavender. After the mixture has become entirely homogeneous, remove the source of heat, and add 30 to 40 parts more of oil of lavender. Intimately mix the mass thus obtained with a like quantity of bismuth glass prepared by fusing together equal parts of oxide of bismuth and crystallized boric acid. The paint is to be burned in in the usual manner.

PORCELAIN, HOW TO TELL POTTERY AND PORCELAIN:
See Ceramics.

PORCELAIN STAINS, TO REMOVE:

I. Use a strong solution of oxalic acid, scrubbing with a brush or small mop (oxalic acid is poisonous).

II. When porcelain articles have a brown stain on them, you can remove same by letting concentrated hydrochloric acid trickle on the stain until it is removed (a medicine dropper can be used if stain is not a large one). Wash thoroughly afterwards with water to remove all trace of acid.

POTATO STARCH:
See Starch.

POTTERY:
See Ceramics.

POULTRY APPLICATIONS:
See Insecticides.

POULTRY FOODS AND POULTRY DISEASES AND THEIR REMEDIES:
See Veterinary Formulas.

POULTRY WINE:
See Wines and Liquors.

POWDER FOR COCKROACHES:

Chamomile	1	ounce
Borax	6	ounces
Insect powder	1	ounce
Plaster Paris	½	ounce
Sulphur	1½	ounces

These ingredients should be in powder form and thoroughly mixed. This powder should be sprinkled around where cockroaches collect or run.

POWDERS FOR STAMPING:
See Stamping.

POWDERS FOR THE TOILET:
See Cosmetics.

Preservatives

(See also Foods.)

Preservative Fluid for Museums.—

Formaldehyde solution	6 parts
Glycerine	12 parts
Alcohol	3 parts
Water	100 parts

The addition of glycerine becomes necessary only if it is desired to keep the pieces in a soft state. Filtering through animal charcoal renders the liquid perfectly colorless. For dense objects, such as lungs and liver, it is best to make incisions so as to facilitate the penetration of the fluid. In the case of very thick pieces, it is best to take 80 to 100 parts of formaldehyde solution for above quantities.

Preservative for Stone, etc.—A new composition, or paint, for protecting stone, wood, cement, etc., from the effects of damp or other deleterious influences consists of quicklime, chalk, mineral colors, turpentine, boiled oil, galipot, rosin, and benzine. The lime, chalk, colors, and turpentine are first fixed and then made into a paste with the boiled oil. The paste is finely ground and mixed with the rosins previously dissolved in the benzine.

Preservative for Stuffed Animals.— For the exterior preservation use

Arsenic	0.7 parts
Alum	15.0 parts
Water	100.0 parts

For sprinkling the inside skin as well as filling bones, the following is employed:

Camphor	2 parts
Insect powder	2 parts
Black pepper	1 part
Flowers of sulphur	4 parts
Alum	3 parts
Calcined soda	3 parts
Tobacco powder	3 parts

Preservatives for Zoological and Anatomical Specimens.—The preparations are first placed in a solution or mixture of

Sodium fluoride	5 parts
Formaldehyde (40 per cent)	2 parts
Water	100 parts

After leaving this fixing liquid they are put in the following preservative solution:

Glycerine (28° Bé.)	5 parts
Water	10 parts
Magnesium chloride	1 part
Sodium fluoride	0.2 parts

In this liquid zoological preparations, especially reptiles, retain their natural coloring. Most anatomical preparations likewise remain unchanged therein.

PRESERVATIVES FOR WOOD:
See Wood.

Preserving

Canning.—There should be no trouble in having canned fruit keep, well if perfect or "chemical cleanliness" is observed in regard to jars, lids, etc., and if the fruit or vegetables are in good order, not overripe or beginning to ferment where bruised or crushed. Fruit will

never come out of jars better than it goes in. It is better to put up a little fruit at a time when it is just ripe than to wait for a large amount to ripen, when the first may be overripe and fermenting and likely to spoil the whole lot. Use only the finest flavored fruit.

Have everything ready before beginning canning. Put water in each jar, fit on rubbers and tops, and invert the jar on the table. If any water oozes out try another top and rubber until sure the jar is air-tight. Wash jars and tops, put them in cold water and bring to a boil. When the fruit is cooked ready take a jar from the boiling water, set it on a damp cloth laid in a soup plate, dip a rubber in boiling water, and fit it on firmly. Fill the jar to overflowing, wipe the brim, screw on the top, and turn it upside down on a table. If any syrup oozes out empty the jar back into the kettle and fit on a tighter rubber. Let it stand upside down till cold, wipe clean, wrap in thick paper, and keep in a cool, dry place.

These general directions are for all fruits and vegetables that are cooked before putting in the jars. Fruit keeps its shape better if cooked in the jars, which should be prepared as above, the fruit carefully looked over and filled into the jars. If a juicy fruit, like blackberries or raspberries, put the sugar in with it in alternate layers. For cherries the amount of sugar depends on the acidity of the fruit and is best made into a syrup with a little water and poured down through them. Peaches and pears after paring, are packed into the jars and a syrup of about a quarter of a pound of sugar to a pound of fruit poured over them. Most fruits need to be cooked from 10 to 15 minutes after the water around them begins to boil.

Red raspberries ought not to be boiled. Put them into jars as gently as possible; they are the tenderest of all fruits and will bear the slightest handling. Drop them in loosely, fold a saucer into a clean cloth, and lay over the top, set on a perforated board in a boiler, pour water to two-thirds, cover and set over a slow fire. As the fruit settles add more until full. When it is cooked soft lift the jar out and fill to the top with boiling syrup of equal parts of sugar and water, and seal.

Do not can all the fruit, for jams and jellies are a welcome change and also easier to keep. Raspberries and currants mixed make delicious jam. Use the juice of a third as many currants and ¾ of a pound of sugar to a pound of fruit. The flavor of all kinds of fruit is injured by cooking it long with the sugar, so heat the latter in the oven and add when the fruit is nearly done.

Jelly is best made on a clear day, for small fruits absorb moisture, and if picked after a rain require longer boiling, and every minute of unnecessary boiling gives jelly a less delicate color and flavor. When jelly is syrupy, it has been boiled too long; if it drops from the spoon with a spring, or wrinkles as you push it with the spoon in a saucer while cooling, it is done enough. Try it after 5 minutes' boil. Cook the fruit only until the skin is broken and pulp softened. Strain without squeezing for jelly, and use the last juice you squeeze out for jam. Measure the juice and boil uncovered, skimming off. For sweet fruits ¾ of a pound of sugar is enough to a pint of juice. Heat the sugar in the oven, add to the boiling juice; stir till dissolved. When it boils up, draw to the back of the stove. Scald the jelly glasses, fill and let stand in a clean, cool place till next day; then cover. Blackberries make jelly of a delicious flavor and jelly easily when a little underripe. Currants should be barely ripe; the ends of the bunches may be rather green.

A highly prized way of canning cherries: Stone and let them stand overnight. In the morning pour off the juice, add sugar to taste, and some water if there is not much juice, and boil and skim till it is a rich syrup. If the cherries are sweet a pint of juice and ¾ of a pint of sugar will be right. Heat the jars, put in the uncooked cherries till they are nearly full; then pour over them the boiling syrup and fasten on the covers. Set the jars in a washboiler, fill it with very hot water and let it stand all night. The heat of the syrup and of the water will cook the fruit, but the flavor and color will be that of fresh and uncooked cherries.

Canning without Sugar.—I.—In order to preserve the juices of fruit merely by sterilization, put the juice into the bottles in which it is to be kept, filling them very nearly full; place the bottles, unstop pered, in a kettle filled with cold water, so arranging them on a wooden perfor ated "false bottom," or other like contrivance, as to prevent their immediate contact with the metal, thus preventing unequal heating and possible fracture. Now heat the water, gradually raising the temperature to the boiling point, and maintain at that until the juice attains a boiling temperature; then close the bot tles with perfectly fitting corks, which

have been kept immersed in boiling water for a short time before use. The corks should not be fastened in any way, for if the sterilization is not complete, fermentation and consequent explosion of the bottle might occur, unless the cork should be forced out. The addition of sugar is not necessary to secure the success of the operation; in fact a small proportion would have no antiseptic effect. If the juice is to be used for syrup as for use at the soda fountain, the best method is to make a concentrated syrup at once, using about 2 pounds of refined sugar to 1 pint of juice, dissolving by a gentle heat. The syrup may be made by simple agitation without heat and a finer flavor thus results, but its keeping quality would be uncertain.

II.—Fruit juices may be preserved by gentle heating and after protection from the air in sterilized containers. The heat required is much below the boiling point. Professor Müller finds that a temperature of from 140° to 158° F., maintained for 15 minutes, is sufficient to render the fermenting agents present inactive. The bottles must also be heated to destroy any adherent germs. The juices may be placed in them as expressed and the container then placed in a water bath. As soon as the heating is finished the bottles must be securely closed. The heating process will, in consequence of coagulating certain substances, produce turbidity, and if clear liquid is required, filtration is, of course, necessary. In this case it is better to heat the juice in bulk in a kettle, filter through felt, fill the bottles, and then heat again in the containers as in the first instance. It is said that grape juice prepared in this manner has been found unaltered after keeping for many years. Various antiseptics have been proposed as preservatives for fruit juices and other articles of food, but all such agents are objectionable both on account of their direct action on the system and their effect in rendering food less digestible. While small quantities of such drugs occasionally taken may exert no appreciable effect, continuous use is liable to be more or less harmful.

CRUSHED FRUIT PRESERVING:

Crushed Pineapples.—Secure a good brand of canned grated pineapple and drain off about one-half of the liquor by placing on a strainer. Add to each pound of pineapple 1 pound of granulated sugar. Place on the fire and bring to boiling point, stirring constantly. Just before removing from the fire, add to each gallon of pulp 1 ounce saturated alcoholic solution salicylic acid. Put into air-tight jars until wanted for use.

Crushed Peach.—Take a good brand of canned yellow peaches, drain off liquor, and rub through a No. 8 sieve. Add sugar, bring to the boiling point, and when ready to remove from fire add to each gallon 1 ounce saturated alcoholic solution of salicylic acid. Put into jars and seal hermetically.

Crushed Apricots.—Prepared in similar manner to crushed peach, using canned apricots.

Crushed Orange.—Secure oranges with a thin peel and containing plenty of juice. Remove the outer or yellow peel first, taking care not to include any of bitter peel. The outer peel may be used in making orange phosphate or tincture sweet orange peel. After removing the outer peel, remove the inner, bitter peel, quarter and remove the seeds. Extract part of the juice and grind the pulp through an ordinary meat grinder. Add sugar, place on the fire, and bring to the boiling point. When ready to remove, add to each gallon 1 ounce saturated alcoholic solution of salicylic acid and 1 ounce glycerine. Put into jars and seal.

Crushed Cherries.—If obtainable, the large, dark California cherry should be used. Stone the cherries, and grind to a pulp. Add sugar, and place on the fire, stirring constantly. Before removing, add to each gallon 1 ounce of the saturated solution of salicylic acid. Put into jars and seal.

Dry Sugar Preserving.—The fruits are embedded in a thick layer of dry, powdered sugar to which they give up the greater part of the water contained in them. At the same time, a quantity of sugar passes through the skins into the interior of the fruits. Afterwards, the fruits are washed once, wiped, and completely dried.

Fruit Preserving.—Express the juice and filter at once, through two thicknesses of best white Swedish paper, into a container that has been sterilized immediately before letting the juice run into it, by boiling water. The better plan is to take out of water in active ebullition at the moment you desire to use it. Have ready some long-necked, 8-ounce vials, which should also be kept in boiling water until needed. Pour the juice into these, leaving room in the upper part of the body of the vial to re-

ceive a teaspoonful of the best olive oil. Pour the latter in so that it will trickle down the neck and form a layer on top of the juice, and close the neck with a wad of antiseptic cotton thrust into it in such manner that it does not touch the oil, and leaves room for the cork to be put in without touching it. Cork and cap or seal the vial, and put in a cool, dark place, and keep standing upright. If carried out faithfully with due attention to cleanliness, this process will keep the juice in a perfectly natural condition for a very long time. The two essentials are the careful and rapid filtration, and the complete asepticization of the containers. Another process, in use in the French Navy, depends upon the rapid and careful filtering of the juice, and the addition of from 8 to 10 per cent of alcohol.

Raspberry Juice.—A dark juice is obtained by adding to the crushed raspberries, before the fermentation, slight quantities of sugar in layers. The ethyl-alcohol forming during the fermentation is said to cause a better extraction of the raspberry red. Furthermore, the boiling should not be conducted on a naked fire, but by means of superheated steam, so as to avoid formation of caramel. Finally, the sugar used should be perfectly free from ultramarine and lime, since both impurities detract from the red color of the raspberries.

Spice for Fruit Compote.—This is greatly in demand in neighborhoods where many plums and pears are preserved.

	Parts		Parts
Lemon peel.....	15	or	...
Cinnamon, ordinary.....	15	or	50
Star aniseed	10	or	15
Coriander.....	3	or	100
Carob pods.....	5	or	..
Ginger root, pecled.....	2	or	200
Pimento.....	..	or	100
Licorice.....	..	or	100
Cloves, without stems.....	..	or	30
Spanish peppers.	..	or	2
Oil of lemon.....	..	or	4
Oil of cinnamon.	..	or	2
Oil of cloves.....	..	or	2

All the solid constituents are powdered moderately fine and thoroughly mixed; the oils dropped in last, and rubbed into the powder.

Strawberries.—Carefully remove the stems and calyxes, place the strawberries on a sieve, and move the latter about in a tub of water for a few moments, to remove any dirt clinging to them. Drain and partially dry spontaneously, then remove from the sieve and put into a porcelain-lined kettle provided with a tight cover. To every pound of berries take a half pound of sugar and 2 ounces of water and put the same in a kettle over the fire. Let remain until the sugar has dissolved or become liquid, and then pour the same, while still hot, over the berries, cover the kettle tightly and let it stand overnight. The next morning put the kettle over the fire, removing the cover when the berries begin to boil, and let boil gently for 6 to 8 minutes (according to the mass), removing all scum as it arises. Remove from the fire, and with a perforated spoon or dipper take the fruit from the syrup, and fill into any suitable vessel. Replace the syrup on the fire and boil for about the same length of time as before, then pour, all hot, over the berries. The next day empty out the contents of the vessel on a sieve, and let the berries drain off; remove the syrup that drains off, add water, put on the fire, and boil until you obtain a syrup which flows but slowly from the stirring spoon. At this point add the berries, and let boil gently for a few moments. Have your preserve jars as hot as possible, by putting them into a pot of cold water and bringing the latter to a boil, and into them fill the berries, hot from the kettle. Cool down, cover with buttered paper, and immediately close the jars hermetically. If corks are used, they should be protected below with parchment paper, and afterwards covered with wet bladder stretched over the top, securely tied and waxed. The process seems very troublesome and tedious, but all of the care expended is repaid by the richness and pureness of the flavor of the preserve, which maintains the odor and taste of the fresh berry in perfection.

Hydrogen Peroxide as a Preservative.—Hydrogen peroxide is one of the best, least harmful, and most convenient agents for preserving syrups, wine, beer, cider, and vinegar. For this purpose 2½ fluidrachms of the commercial peroxide of hydrogen may be added to each quart of the article to be preserved. Hydrogen peroxide also affords an easy test for bacteria in water. When hydrogen peroxide is added to water that contains bacteria, these organisms decompose it, and consequently oxygen gas is given off. If the water be much contaminated the disengagement of gas may be quite brisk.